WOOD PANEL ATTACHMENT SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates generally to a locking mechanism assembly. In particular, the present invention relates to a cam locking system for assembling various structures such as home furniture.

Home furniture systems exhibiting superior structural characteristics and which exhibit flexibility and interchangeably among parts to create adjustable shelving systems are in demand for many applications. In particular, the advent of home theater systems has created a need for adjustable and quick-to-assemble furniture to store and display home theater equipment. There are a wide variety of entertainment centers available on the market which require the user to assemble the furniture. Typical assembly includes the use of screws and bolts and other such permanent, unadjustable fasteners. The main structure comes with predrilled holes or pre-made slots for the placement of fasteners. The drawback of these systems is the lack of adjustability for the shelves to accommodate different sizes of home theater equipment.

Prior art systems have tried to overcome the problem of adjustability in various ways. One way is to use a structure utilizing a host structure that contains a slot running the entire length of the structure. A common example of this is an extruded geometrically configured tube. Furniture can be made using a plurality of these tubes with appropriate cross supports, such as shelves or side panels. Thus, furniture may be constructed by fastening items to the geometric tubes.

Different methods for connecting shelves or walls to a host structure formed of an extruded geometric tube have been disclosed. For example, U.S. Patent No. 6,161,262, discloses a clamp assembly which is installed in a slot in the host structure at any position along the slot. This allows for adjustability of the clamp assembly. However, this assembly must be used by rotating a screw

perpendicular to the slot, thus preventing the clamping device from being part of a linear shelf.

Similarly, U.S. Patent 6,286,192 discloses a clamp assembly for use in a host structure that has a slot. In this clamping structure, four pieces must be utilized to adjust it, including two clamp bodies composed of two opposing jaws each having teeth for entering into a slot in the host structure, a rod between the two, and a screw for adjusting the clamp.

Thus, there is a need in the art for a shelving system that overcomes the drawbacks of these prior art systems by providing a system which is simple, yet has great versatility and adjustability.

BRIEF SUMMARY OF THE INVENTION

The present invention is not only practical but provides an attractive, structurally sound, free standing final product which is ideally suited for modern entertainment systems. The system is easy to assemble and disassemble by relatively unskilled laborers.

The invention is an improved fastening system for a host structure containing slots and a support member, such as a shelf or panel, to be attached to the host structure by using the slots. The support member to be attached to the host structure contains a locking member and a cam for tightening the locking member. This allows for the support member to be easily adjusted along the slot contained in the host structure. In addition, the support member can be attached to the host structure perpendicularly, parallel to, or at an angle as well.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of an entertainment center.

Figure 2 is a top perspective view of two host structures connected to a cross support member.

Figure 3 is an assembly view showing the host structure, a locking body, a cam and the cross support member.

Figure 4 illustrates a cross sectional view of the host structure, locking body, cam and cross support member.

Figure 5 illustrates a side view of the cam and locking body in a locked position and an unlocked position.

Figure 6 illustrates a shelving assembly in an unlocked position.

Figure 7 illustrates the shelving assembly in a locked position.

DETAILED DESCRIPTION

Fig. 1 shows a perspective view of an entertainment center containing host structures 10a-10f and cross supports 12a-12c. Preferably, all numbered host structures 10a-10f are of the same dimension, thus creating a uniform part. The cross supports 12a-12c are panels of the same dimensions. The cross supports 12a-12c are fastened to the host structures 10a-10f. With the configuration present, the cross supports 12a-12c provide the base of the structure, and thus no horizontal or other angled supports are required. The host structures 10a-10f contain slots on all four sides so cross supports 12a-12c can be attached to any of the faces of host structures 10a-10f.

In assembling the entertainment center illustrated in Fig. 1, or similar furniture, one cross support 12a is first attached to host structure 10e. Next, another cross support 12b is attached to host structure 10 at 90°, creating a L-shape structure which is able to stand by itself. Host structure 10d attaches to the face of cross support 12a that parallel to the face attached to host structure 10e. Similarly, host structure 10f attaches to the face of cross support12b that is parallel to the face attached to host structure 10e. Two more cross supports (not shown) can be added at 90° of cross supports12a and 12b, respectively, to create a rectangle when viewed from the top. A final host structure (not shown) is placed in the corner previously without a host structure 10, thus completing the free standing assembly. A top panel and a bottom panel are mounted to the structure to form an enclosure and complete construction of the item of furniture.

Fig. 2 shows a cross support 12 positioned between two host structures 10. Each host structure 10 is an extruded geometrically configured tube having slotted surfaces. The host structure 10 can have a number of slots 14, and in the example illustrated, four are provided. Although a rectangular tube is shown the host structure 10 could be of numerous shapes and forms. The host structure 10 is constructed from various materials such as metal, composites, or polymers.

Slots 14 contained in the host structure 10 are for the accommodation and engagement of fasteners. In the preferred embodiment, the tube of the host structure 10 has slots 14 on all sides, which allows for utilizing one or multiple sides for the reception fasteners.

In Fig. 2, the cross support 12 is a side panel. The cross support 12 can be of varying length, width, and thickness so long as there is room for a locking mechanism 16 to be installed within the body of the cross support 12. The sides of the cross support 12 may be beveled to obtain a desired mating with a surface of the host structure 10 if the host structure 10 is of a non-rectangular shape. In one embodiment, the cross support 12 is of a thickness that is nominally the same as the outer dimension of a parallel side of a rectangular host structure 10 that attaches to the cross support 12. In such an embodiment, the parallel faces of the host structure 10 are flush with the corresponding parallel faces of the cross support 12.

As illustrated in Fig. 2, there are four locking mechanisms 16 installed in the cross support 12. The number of locking mechanisms 16 in a cross support 12 will vary depending upon the dimensions required for a particular finished item. The cross support 12 can be made of composites, particle wood product, or a wood board. The cross support 12 used in the furniture structures are constructed with pre-drilled holes or other such means as to accommodate the placement of shelves within an enclosure created by the cross supports 12 and host structures 10. The locking mechanism 16 is used to connect the host structure 10 with the cross support 12.

Fig. 3 is an exploded view of one embodiment of the locking mechanism 16 showing the host structure 10, support structure 12, locking body 18, and cam 20. The locking mechanism 16 is a fastener made from the combination of the locking body 18 and cam 20. Fig. 3 illustrates the host structure 10 as a rectangular geometrically configured tube with slots 14a-14c, including the slot 14c on the right side and 14b on the top side. The slots 14a-14c are created by a portion

of the surface of the extruded geometrical tube. Struts 15a and 15b extend downward from the outer surface of the host structure 10, and opposing segments 13a and 13b protrude perpendicular from the ends of the strut to define the top of slot 14b. Bottom segment 17 defines the lower boundary of the slot 14b.

A second embodiment contains slots 14 comprising the structure described, but offset to one side rather than centered on each face of the rectangular host structure 10. In this embodiment, the offset allows a cross support 12 that has a thickness thinner than the dimension of the side of the host structure 10 to be positioned in a manner where a face of cross support 12 is flush with the outer face of the host structures 10 parallel to the cross support 12.

Pictured in Fig. 3 is the corner of cross support 12 in which a section has been removed, thus showing a cross sectional view of the location of the locking mechanism 16 within the cross support 12. There is a hole 22 drilled vertically through the cross support 12 to a predetermined depth, and a hole 26 drilled through the cross support 12 horizontally to a predetermined depth that terminates upon intersecting the vertical hole 22. The cam 20 mounts in the vertical hole 22 leaving a slotted surface 24 flush with cross support 12 or below the surface of cross support 12. This allows the panel to be installed without requiring a finishing of fastening devices. The cam 20 contains slotted surface 24 for rotational activation using an ordinary tool, such as a screwdriver or allen wrench.

Also pictured in Fig. 3 is the locking body 18. The locking body 18 can be made using various products by various methods such as machining, thermal molding, or casting. The locking body 18 is composed of five parts- an engagement disk 32, a distal neck 34, a central shaft 36, a proximal neck 38, and a ball 40. The locking body has on its proximal end ball 40 made to fit into cam 20. The distal end contains round engagement disk 32. In the preferred embodiment, the engagement disk 32 is sized so that it may be movable within the slot 14c when the cam 20 is in an unlocked or open position, as explained later. The engagement disk

32 will not be able to be removed from the slot 14c when the locking body 18 is centrally located within slot 14c and pulled towards the outer edge of the slot 14c in the host structure 10.

Preferably, the engagement disk 32 is sized to allow insertion of locking body 18 into slot 14b by angling the locking body 18 and inserting one edge of the engagement disk 32 into the slot 14b first, and then leveling the locking body 18 to rest perpendicular against the face of the host structure 10. Upon being brought to perpendicular, the edge opposite of the edge of the engagement disk 32 initially inserted in slot 14b will not interfere with either opposing segment 13a or 13b on the end of respective perpendicular struts 15a and 15b of slot 14b on the host structure 10. This allows for the locking body 18 to be inserted from at any point along the slot 14b in the host structure 10, providing adjustability along the entire length of the slot. The engagement disk 32 could also be of other shapes, such as cylindrical, rectangular, or polygonal, so long as it engages both sides of the slot 14.

The locking body 18 also has a central shaft 36 that is made to fit into horizontal hole 26 of the cross support 12. The central shaft 36 diameter is the same or slightly smaller of that of the horizontal hole 26, and the shaft is concentrically aligned with the hole in the cross support 12 allowing for linear, reciprocal movement of the shaft within the aperture of the horizontal hole 26. Although the preferred embodiment is for a cylindrical shaft, any shape of the slot 14 and corresponding central shaft 36 would work that allows for reciprocating motion.

Between the engagement disk 32 and the central shaft 36 is the distal neck 34. Preferably, the distal neck 34 is cylindrical. The diameter is smaller than that of the central shaft 36, and is of a diameter which allows the engagement disk 32 to be inserted into slot 14 without impediment as previously described.

Similarly, between the central shaft 36 and the ball 40 is the proximal neck 38. The diameter of this cylindrical neck fits between tabs 52 and 54 of the cam 20.

Fig. 4 is a cross sectional view of the locking mechanism 16 with the cross support 12 abutting the host structure 10. The locking mechanism 16 is in a closed position. As illustrated ball 40 is cradled within of the cam 20, and that the engagement disk 32 is pulled tight against the outer edge of the slot 14. The cam 20 and locking body 18 are positioned within the cross support 12 such that in the engaged position, the edge of the engagement disk 32 is abutting opposing segments 13a and 13b in the slot 14 the host structure 10. As a result, the cross support 12 is held firmly in place against the host structure 10.

Fig. 5 is an isometric view of the locking body 18 and cam 20. The cam 20 has two tabs 52 and 54, extending upward from the centerline of the cam 20. These two tabs 52 and 54 form an opening which receives the proximal neck 38 of the locking body 18. The distance between the tabs 52 and 54 is less than the nominal diameter of ball 40. Thus, ball 40 prevents the locking body 18 from disconnecting with the cam 20 by impeding linear motion of the locking body 18 past the tabs 52 and 54 of the cam. Also, the cam 20 has been hollowed out spherically to allow for reception of the ball 40 of the locking body 18. As is shown by arrow 56, upon rotating the cam 20 90° counterclockwise from the initial position, the locking body 18 is linearly pulled to the left as represented by arrow 58. This results from the original ball 40 placement in the cam 20 at the starting position not centered concentrically with the cam itself. As the cam 20 is turned, the angle of the hollowed out sphere section engages the ball 40 and pulls it toward the center of the cam 20. The small amount of rotation required to engage the locking mechanism allows for quick assembly of cross supports 12 and host structures 10. Rotating the cam 90° clockwise from the initial position will align the cam 20 so that the tabs 52 and 54 are no longer around the proximal neck 38.

Thus, the locking body 18 can be removed entirely from the cam 20, with the ball 40 not being impeded by the tabs 52 and 54 of the cam 20.

The practical result of this can be seen in Figs. 6 and 7. Fig. 6 shows a side view of host structure 10, cross support 12, and locking body 18 engagement disk 32 and distal neck 34. There is a space between host structure 10 and cross support 12 denoting that the locking mechanism 16 is in the open position. Fig. 7 shows the engagement disk 32 flush against the host structure 10 thus pulling cross support 12 flush against the outer edge of host structure 10. Although a rectangular structure is pictured, using host structures 10 of differing geometries can be used to create differing structures such as a trapezoid or other polygon. This is accomplished by altering the dimensions of the host structures 10 and cross supports 12.

In an alternate embodiment, a bumper (not shown) is connected to the locking body on the distal end. In this embodiment, the bumper is rubber or a similarly elastic material that allows for cushioning between the tube face in the slot and the locking body. Preferably, the bumper is adhesively attached to the locking member, and is concentric with the distal face of the engagement disk 32. Such bumpers are readily obtained at hardware stores, such as a 3M Bump-on™. The cushioning of the bumper allows the locking body 18 to be inserted into the slot 14 in the host structure 10 and remain in place due to the outward pressure exerted on the proximal face of the engagement disk 32 from the spring action of the elastic material pushing against the tube face in the slot 14. Once placed, a cross support 12 can be aligned so that the horizontal hole 26 receives a preplaced locking body 18. Once the cross support 12 is positioned so that the cam 20 is engaging the ball 40 of the locking body 18, the cam 20 can be rotated to fasten the host structure 10 and cross support 12.

In a second alternate embodiment, the cross support 12 contains a tongue (not shown) on the edge that abuts the host structure 10. The tongue can

extend partially or the entire length of cross support 12, and helps in the alignment of the host structure 10 and cross support 12 to be assembled. The tongue is notched to allow the locking body 18 to enter the slot in the host structure 10. Preferably, the tongue itself is a width allowing fit between the opposing segments 13a and 13b perpendicular to the struts 15a and 15b of the slot 14 in the host structure 10. The tongue's thickness is no more that the depth of the slot 14 in the host structure 10. The tongue adds structural support between the host structures 10, but still allow the face of the host structure 10 and surface at the end of the tongue on the cross support 12 to be flush to one another when the locking body 18 and cam 20 are engaged.

In another alternate embodiment, the rectangular tube of the host structure 10 contains an extension from a corner of the host structure 10 to create a channel. The extension comprises a flat surface extending perpendicular to the surface of the tube, and another surface that is angled or arced that begins at the corner of the tube of the host structure 10 and terminates at a point near the intersection with the flat surface. The opposite end of the channel comprises a segment perpendicular to the surface of the host structure 10, which may also comprise the strut 15. The extension covers the edge of a cross support 12 mounted to the host structure 10 to conceal any imperfections along the edge, such as chipping or splintering of the material, of the cross support 12. In this alternate embodiment, the tongue of the cross support 12 mates into a channel in the host structure 10. The channel comprises an extension on the host structure 10 and the surface of the host structure 10 near the slot 14. In such an embodiment, the tongue is not notched, and extends the entire length of the cross support.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.